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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,711	04/13/2001	Luc Ouellet	10932-US	4962

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EXAMINER	
MARKHAM, WESLEY D	
ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 10/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/833,711	OUELLET ET AL.	
	Examiner	Art Unit	
	Wesley D Markham	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 April 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2 total* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1 – 25 are currently pending in U.S. Application Serial No. 09/833,711, and an Office Action on the merits follows.

Information Disclosure Statement

2. Acknowledgement is made of the IDSs (2) filed by the applicant on 4/13/2001 and 10/3/2002. The references listed thereon have been considered by the examiner as indicated on the attached copies of the PTO-1449 forms.

Drawings

3. Acknowledgement is made of the formal drawings (20 sheets, 20 figures) filed by the applicant on 4/13/2001.
4. The drawings are objected to because the legends in Figures 5a, 5b, 6a, 7a, 8a, 9a, and 10a are either too small or too blurry to be read. A proposed drawing correction or corrected drawings are required in reply to the Office Action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The following title is

suggested: "Method of depositing optical quality silica films by PECVD while controlling gas pressure".

6. The lengthy specification (34 pages, excluding claims) has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

7. The disclosure is objected to because of the following informalities:

   - Page 8, line 26: It appears as though the word "high" is mistakenly capitalized (i.e., written as "High").
   - Page 10, lines 12 – 13: The phrase, "Typically, the deposition is carried out with SiH_4 as a raw material gas N_2O as an oxidation gas is, N_2 as a carrier gas, although other materials can be used" appears to contain typographical errors. It appears as though the phrase should read, "Typically, the deposition is carried out with SiH_4 as a raw material gas, N_2O as an oxidation gas, and N_2 as a carrier gas, although other materials can be used".
   - Pages 15 – 32: Throughout the "DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS" section of the applicant's specification, the figure numbers referred to by the applicant do not correctly correspond to either the figures themselves or the description of the figures presented in the "BRIEF DESCRIPTION OF THE DRAWINGS" section. For example, on page 15, line 14, the applicant states that Figure 4 lists the possible chemical reactions that may result from the exposure of the thirty-five (35) potential as-

deposited compounds to nitrogen at very high temperatures. This statement is incorrect, as Figure 4 shows various FTIR fundamental infrared absorption peaks. Figure 3 lists the possible chemical reactions that may result from the exposure of the thirty-five (35) potential as-deposited compounds to nitrogen at very high temperatures. As another example, on page 32, line 23, the applicant states that Figure 15 shows the effect of the N_2O gas flow... This statement cannot be correct because there is no Figure 15 present in the application. These discrepancies are found throughout the entire "DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS" section of the applicant's specification, and the applicant is suggested to carefully review and examine the specification in order to correct all such discrepancies so that the correct figures are recited throughout the application.

Appropriate correction is required.

Claim Objections

8. Claim 10 is objected to because of the following informalities: The claim recites, in part, "wherein said reactive gas is selected from the group consisting of..." However, Claim 9 (from which Claim 10 depends) uses the terminology "raw material gas", not "reactive gas". As such, it appears as though the aforementioned phrase in Claim 10 contains a typographical error and should recite, "wherein said raw material gas is selected from the group consisting of..." in order to clearly correspond to the terminology used in Claim 9. Appropriate correction is required.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 10 – 12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

11. Specifically, Claim 10 (from which Claims 11 and 12 depend) recites, in part, "...and any other silicon containing gases involving the use of hydrogen, H, chlorine, Cl, fluorine, F, bromine, Br, and iodine, I". This limitation renders Claims 10 – 12 vague and indefinite because it is unclear whether the "other silicon containing gases" (1) must include all of H, Cl, F, Br, and I (a relatively small group of gases), or (2) must include at least one of H, Cl, F, Br, and I (a relatively large group of gases). The interpretation of this limitation clearly affects the scope of the claims, and, since this limitation is unclear, the scope of Claims 10 – 12 is also unclear, and the claims are indefinite under 35 U.S.C. 112, second paragraph.

Claim Observations

12. The examiner notes that the limitation, "forming said optical quality silica film..." in independent Claims 1 and 21 has been interpreted by the examiner to exclude films such as SiON and/or SiONH because such films include contaminant elements such

as N and H and are therefore not "optical quality silica films", as required by the claims of the instant application. In fact, SiON and SiONH films are not silica films at all, but are oxynitride films.

Claim Rejections - 35 USC § 102

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

14. Claims 1 – 4, 7, 9, 14, and 19 – 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Shioya et al. (USPN 4,394,401).

15. Regarding independent **Claims 1 and 21**, Shioya et al. teaches a method of depositing a phosphosilicate glass (PSG) (i.e., silica) film on a substrate (Abstract), the method comprising forming the PSG film on the substrate, specifically at a temperature between 100 and 650° C, by plasma enhanced chemical vapor deposition (PECVD) in the presence of gases, specifically a raw material gas (i.e., silane), an oxidation gas (i.e., nitrous oxide), and a carrier gas (i.e., argon), while controlling the total pressure of the gases, specifically to a pressure of between 2.0 to 2.6 Torr, (Abstract, Col.1, lines 8 – 14, Col.2, lines 44 – 68, Col.3, lines 1 – 7, and Examples 1 and 2), and subjecting the as-deposited film to a low temperature treatment between 400° to 1200° C, specifically at about 800° C (Col.1, lines 59 –

63, and Col.3, lines 45 – 52). Shioya et al. does not explicitly teach that (1) the PSG film (i.e., the silica film) is "optical quality", and (2) the low temperature treatment is performed to minimize the presence of contaminant compounds such as Si-O-H-N in the film. However, Shioya et al. teaches each and every process step and limitation of the applicant's claims, including the specifics of the PECVD process (i.e., substrate temperature, reactant gas, oxidation gas, total gas pressure, etc.) and the heat-treatment process (i.e., temperature). Therefore, unless essential process steps and/or limitations are missing from the applicant's claims, the combined deposition / annealing process of Shioya et al. would have inherently produced an "optical quality" silica film as claimed by the applicant, and the annealing process of Shioya et al. would have inherently minimized the presence of contaminant compounds such as Si-O-H-N in the film. Please note that the mere observation of still another beneficial result (i.e., that annealing a PECVD silica film reduces contaminants in the film) of an old process cannot form the basis of patentability (*Allen et al. v Coe*, 57 USPQ 136). Regarding **Claim 2**, Shioya et al. does not explicitly teach that the total pressure is controlled to minimize the presence of Si-O-H-N compounds after the low-temperature treatment. However, the total pressure taught by Shioya et al. (e.g., 2 Torr – see Col.2, lines 65 – 67) is in the preferred range of pressures disclosed and claimed by the applicant (see, for example, applicant's Claim 4). Therefore, since the total pressure taught by Shioya et al. is in the range of pressures claimed by the applicant, the total pressure in Shioya et al. is inherently controlled "to minimize the presence of Si-O-H-N compounds after the

low-temperature treatment". Please note that the mere observation of still another beneficial result (i.e., that a certain range of PECVD silica deposition pressures provides reduced contamination of the silica film) of an old process cannot form the basis of patentability (*Allen et al. v Coe*, 57 USPQ 136). Regarding **Claim 3**, Shioya et al. teaches that the low temperature treatment is carried out at about 800° C (Col.3, line 49). Regarding **Claim 4**, Shioya et al. teaches a total gas pressure of 2 Torr (i.e., a pressure in the range of 2.0 to 2.6 Torr) (Col.2, lines 65 – 67). Regarding **Claim 7**, Shioya et al. teaches a deposition temperature between 100 and 650° C (Col.2, lines 61 – 65). Regarding **Claim 9**, Shioya et al. teaches that the gases comprise a raw material gas, an oxidation gas, and a carrier gas (Col.2, lines 44 – 57). Regarding **Claim 14**, Shioya et al. also teaches that the flow rates of the gases are controlled to optimize the quality of the deposited films after the low temperature treatment (Abstract and Col.3, lines 8 – 24 and 61 – 64). Regarding **Claims 19 and 20**, Shioya et al. teaches that modifiers such as P, B, Ge, Ti, or F are incorporated into the films during deposition (Col.2, lines 48 – 57). Since the modifiers taught by Shioya et al. (e.g., boron, phosphorous, etc.) are the same as the applicant's claimed modifiers, the refractive index of the film would have inherently been modified as required by Claim 19.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

18. Claims 8 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shioya et al. (USPN 4,394,401).

19. Shioya et al. teaches all the limitations of Claims 8 and 23 as set forth above in paragraph 15, except for a method wherein the film is deposited at a temperature of about 400° C. However, Shioya et al. teaches that the preferred deposition temperature is from 300° C to 450° C (Col.2, lines 64 – 65). The applicant's claimed temperature is squarely within the center of the range of temperatures disclosed by Shioya et al. It would have been obvious to one of ordinary skill in the art to deposit the films of Shioya et al. at a temperature of 400° C, as claimed by the applicant, because such a temperature is within the preferred temperature range of Shioya et

al., and one of ordinary skill in the art would have reasonably expected such a temperature to be both operable and preferable, as taught by Shioya et al.

20. Claims 1, 4, 5, 7 – 9, 13, 19 – 21, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Bouffard et al. (USPN 5,409,743), and in further view of Law et al. (USPN 5,861,197).

21. Regarding independent Claims 1 and 21, Ojha et al. teaches a method of depositing an optical quality silica film on a substrate (Col.1, lines 3 – 8, Col.2, lines 43 – 58, and Col.6, lines 5 – 15), the method comprising forming an optical quality borophosphosilicate glass (BPSG) (i.e., silica) film on a substrate by PECVD in the presence of gases (Col.1, lines 64 – 67, Col.2, lines 1 – 10 and 43 – 57, Col.3, lines 10 – 11, 20 – 24, and 32 – 44, and Col.4, lines 22 – 29), and subjecting the as-deposited film to a low temperature treatment between 400° C to 1200° C, specifically at 800° C, to minimize the presence of contaminant compounds in the film (Col.1, lines 12 – 53 and 64 – 67, Col.2, lines 1 – 10 and 58 – 65, Col.3, lines 52 – 62, and Col.5, lines 20 – 36). Ojha et al. does not teach the specifics of the BPSG PECVD process, such as (1) controlling the total pressure of the gases, specifically the raw material gas, oxidation gas, and carrier gas, during the PECVD process, specifically to a total pressure of between 2.0 to 2.6 Torr, and (2) depositing the film at a temperature between 100 and 650° C. In general, Ojha et al. is silent as to the specifics of the PECVD process, except to say that the PECVD process may involve the use of silane and nitrous oxide as sources for silicon and oxygen, respectively,

for the deposition of the waveguide material (Col.3, lines 19 – 24). Additionally, it is clear that Ojha et al. desire the BPSG cladding layer (i.e., the "optical quality silica film" of the applicant's claims) to have a relatively low flowing temperature so that the cladding can flow during the annealing process (Col.2, lines 47 – 53, and Col.3, lines 39 – 62). Bouffard et al. teaches a PECVD process for depositing a BPSG film that is specifically designed so that the film will flow at a low temperature (as desired by Ojha et al.) (Abstract). Additionally, the BPSG film of Bouffard et al. is highly resistant to defects (Col.2, lines 29 – 36). Bouffard et al. teaches that this high-quality BPSG film is deposited by PECVD and utilizes a raw material gas such as silane, an oxidation gas such as nitrous oxide, and a carrier gas such as nitrogen (Col.4, lines 36 – 59). The film is preferably deposited at a temperature of 400° C (Col.4, line 60, and Col.5, lines 16 – 18), and the total system pressure is in the range of 2.0 to 2.6 Torr, as claimed by the applicant (Col.5, lines 8 – 10, and Figure 2). Additionally, Law et al. teaches that, in the art of PECVD of silica films using silane and nitrous oxide as precursor gases (i.e., a process analogous to that of Ojha et al. and Bouffard et al.), it was known at the time of the applicant's invention to optimize process parameters such as the deposition pressure in order to optimize film deposition characteristics such as the deposition rate (Abstract, Col.3, lines 1 – 6, Col.4, lines 42 – 48, and Col.6, lines 4 – 6). It would have been obvious to one of ordinary skill in the art to deposit the BPSG film of Ojha et al. by utilizing the PECVD process of Bouffard et al. (i.e., a process performed at the applicant's claimed temperature and pressure with the applicant's claimed types of gases) with the

reasonable expectation of successfully and advantageously depositing, by PECVD, a BPSG film that has a relatively low flowing temperature, as desired by Ojha et al., and is highly resistant to defects. Further and in light of Law et al., it would have been obvious to one of ordinary skill in the art to perform the PECVD process while "controlling" the total pressure of the gases of the combination of Ojha et al. and Bouffard et al. to a pressure of, for example, 2.2 to 2.6 Torr, because such a pressure is taught by Bouffard et al. to be preferred, and Law et al. teaches that controlling the pressure during a PECVD process can be successfully done in order to optimize film deposition characteristics, such as the deposition rate. Regarding Claim 21, the combination of Ojha et al., Bouffard et al., and Law et al. does not explicitly teach that the annealing process minimizes the presence of Si-O-H-N compounds in the film. However, Ojha et al. teaches that the annealing process removes undesirable contaminants from the film in general (Col.1, lines 12 – 53 and 64 – 67, Col.2, lines 1 – 10 and 58 – 65, Col.3, lines 52 – 62, and Col.5, lines 20 – 36), and the combination of Ojha et al., Bouffard et al., and Law et al. teaches each and every process step and limitation of the applicant's claims, including the PECVD deposition temperature, the types of process gases, the deposition pressure, and the annealing temperature. As such, the annealing process of Ojha et al. would have inherently minimized the presence of Si-O-H-N compounds in the film, as claimed by the applicant. Please note that the mere observation of still another beneficial result (i.e., that annealing a PECVD silica film specifically reduces Si-O-H-N contaminants

in the film, as opposed to contaminants in general) of an old process cannot form the basis of patentability (*Allen et al. v Coe*, 57 USPQ 136).

22. The combination of Ojha et al., Bouffard et al., and Law et al. also teaches all the limitations of Claims 4, 5, 7 – 9, 13, 19, 20, 23, and 24 as set forth above in paragraph 21 and below, including a method wherein / further comprising:

- Claims 4 and 5: The total gas pressure is controlled to be in the range of 2.0 to 2.6 Torr (Claim 4), specifically to be about 2.4 Torr (Claim 5) (Col.5, lines 8 – 11, and Figure 2 of Bouffard et al.).
- Claims 7, 8, and 23: The film is deposited at a temperature between 100 and 650° C (Claim 7), specifically at about 400° C (Claims 8 and 23) (Col.4, lines 59 – 60, and Col.5, lines 16 – 18 of Bouffard et al.).
- Claim 9: The gases comprise a raw material gas, an oxidation gas, and a carrier gas (Col.4, lines 36 – 59 of Bouffard et al.).
- Claims 13 and 24: The raw material gas is SiH_4 (i.e., silane), the oxidation gas is N_2O (i.e., nitrous oxide), and the carrier gas is N_2 (i.e., nitrogen) (Col.4, lines 36 – 59, and Figure 2 of Bouffard et al.).
- Claims 19 and 20: Modifiers are incorporated into the films during deposition to modify the refractive index (Claim 19), specifically modifiers selected from the group consisting of P, B, Ge, Ti, and F (Claim 20) (Col.3, lines 19 – 24 and 32 – 40 of Ojha et al., and Col.4, lines 40 – 67 of Bouffard et al.).

23. Claims 2, 3, and 14 – 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Bouffard et al. (USPN 5,409,743), in further view of Law et al. (USPN 5,861,197), and in further view of Hsieh et al. ("Characteristics of low-temperature and low-energy plasma-enhanced chemical vapor deposited SiO_2", 1993).

24. The combination of Ojha et al., Bouffard et al., and Law et al. teaches all the limitations of Claims 2 and 3 as set forth above in paragraphs 21 and 22, except for a method wherein the total pressure is controlled to minimize the presence of Si-O-H-N compounds in the film after the low temperature treatment. Please note that the combination of Ojha et al., Bouffard et al., and Law et al. does teach a low temperature treatment at 800° C, as required by Claim 3 (see the discussion of Claim 21 in paragraph 21 above). Additionally and importantly, the combination of Ojha et al., Bouffard et al., and Law et al. reasonably suggests controlling the total pressure during the PECVD process to a value of, for example, 2.4 Torr (i.e., a preferred pressure claimed by the applicant) (see the discussion of Claims 1 and 21 in paragraph 21 above). In addition, Hsieh et al. that, in a process such as the PECVD of silica films (Abstract), the chamber pressure (i.e., the applicant's claimed "total pressure") is one of the more important variables that affect the electrical and physical properties of the films (page 2639, section III.). Therefore, it would have been obvious to one of ordinary skill in the art to control the total pressure in the PECVD process of the combination of Ojha et al., Bouffard et al., and Law et al. to a value of, for example, 2.4 Torr , to not only optimize the deposition rate of the film

(as taught by Law et al.), but also the physical properties of the film, such as producing a film that has reduced contaminants, as generally desired by Ojha et al. Since the process of the combination of Ojha et al., Bouffard et al., Law et al., and Hsieh et al. is identical to the applicant's claimed process, and the total pressure of 2.4 Torr taught by the combination of Ojha et al., Bouffard et al., Law et al., and Hsieh et al. is identical to the applicant's claimed total pressure, the presence of Si-O-H-N compounds in the film after the low temperature treatment of Ojha et al. would have necessarily been minimized by controlling the pressure to such a value.

25. The combination of Ojha et al., Bouffard et al., and Law et al. teaches all the limitations of Claims 14 – 17 as set forth above in paragraphs 21 and 22, except for a method wherein the flow rates of the gases are also controlled to optimize the quality of the deposited films after the low temperature treatment. Please note that Bouffard et al. does teach a silane flow rate of about 0.2 SLM and a nitrous oxide flow rate of 6.0 SLM, as required by Claims 16 and 17 (Figure 2, and Col.5, lines 10 – 16). In addition, Law et al. teaches that processing parameters such as gas flow rates can be optimized to achieve a high quality deposited film (Col.3, lines 1 – 11). Hsieh et al. teaches that process gas flow rates and ratios in a PECVD process are important variables that affect the electrical and physical properties of the deposited films (page 2639, section III.). Therefore, it would have been obvious to one of ordinary skill in the art to control the process gas flow rates in the process of the combination of Ojha et al., Bouffard et al., and Law et al., preferably to control the flow rates to be within the ranges preferred by Bouffard et al., with the reasonable

expectation of successfully and advantageously optimizing the physical and/or electrical quality of the deposited BPSG film.

26. Claims 6 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Bouffard et al. (USPN 5,409,743), in further view of Law et al. (USPN 5,861,197), and in further view of Chandross et al. (USPN 4,708,884).

27. The combination of Ojha et al., Bouffard et al., and Law et al. teaches all the limitations of Claims 6 and 22 as set forth above in paragraphs 21 and 22, except for a method wherein the pressure is maintained by a vacuum pump having a controllable pumping speed, and the total gas pressure is maintained by controlling the pumping speed. Please note that the combination of Ojha et al., Bouffard et al., and Law et al. does teach depositing the film in a vacuum chamber in general, as required by Claims 6 and 22 (Col.4, lines 50 – 53 of Bouffard et al., and Figures 1 and 6 of Law et al.). The combination of Ojha et al., Bouffard et al., and Law et al. is silent as to how the appropriate chamber pressure is maintained. Chandross et al. teaches that it was known in the art of silicon oxide deposition at the time of the applicant's invention to maintain the desired pressure in a vacuum chamber by controlling the pumping speed of a vacuum pump (Col.5, lines 48 – 60). Therefore, it would have been obvious to one of ordinary skill in the art to maintain the desired pressure in the vacuum chamber of the combination of Ojha et al., Bouffard et al., and Law et al. during the PECVD process by controlling the pumping speed of a

vacuum pump, as taught by Chandross et al., with the reasonable expectation of successfully and advantageously maintaining the desired pressure (e.g., 2.4 Torr) by utilizing a well-known, conventional means of doing so. Please note that art-recognized suitability for an intended purpose (in this case, the suitability of a controllable vacuum pump for maintaining the pressure in a vacuum chamber) supports a *prima facie* obviousness determination (MPEP 2144.07).

28. Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Bouffard et al. (USPN 5,409,743), in further view of Law et al. (USPN 5,861,197), and in further view of Hwang (EP 0 935 284 A1).

29. The combination of Ojha et al., Bouffard et al., and Law et al. teaches all the limitations of Claims 10 and 11 as set forth above in paragraphs 21 and 22, except for a method wherein the reactive gas is selected from the silicon-containing gases listed by the applicant in Claim 10. Please note that the combination of Ojha et al., Bouffard et al., and Law et al. does teach utilizing oxygen as the oxidation gas, as required by Claim 11 (Col.4, line 39 of Bouffard et al.). Additonally, the combination of Ojha et al., Bouffard et al., and Law et al. teaches utilizing silane as the reactive gas (Col.3, lines 19 – 22, of Ojha et al., and Col.4, lines 36 – 43 of Bouffard et al.). Hwang teaches that, in a PECVD process used to deposit a silica film, utilizing disilane (Si_2H_6) as the reactive gas as opposed to silane improves the deposition rate of the film (Abstract, Tables 1 – 3, and paragraphs [0001], [0002], [0010],

[0028], and [0029]). Therefore, it would have been obvious to one of ordinary skill in the art to utilize disilane as the reactive gas in the process of the combination of Ojha et al., Bouffard et al., and Law et al. with the reasonable expectation of successfully and advantageously improving the deposition rate of the film.

30. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Bouffard et al. (USPN 5,409,743), in further view of Law et al. (USPN 5,861,197), in further view of Hwang (EP 0 935 284 A1), and in further view of Hsieh et al. ("Characteristics of low-temperature and low-energy plasma-enhanced chemical vapor deposited SiO_2", 1993).

31. The combination of Ojha et al., Bouffard et al., Law et al., and Hwang teaches all the limitations of Claim 12 as set forth above in paragraphs 21, 22, and 29, except for a method wherein the carrier gas is selected from the group consisting of helium, neon, argon, and krypton. Specifically, Bouffard et al. teaches that the carrier gas is nitrogen (Col.4, lines 54 – 59). Hsieh et al. teaches that, by diluting silane and nitrous oxide reactants with a large amount of helium as a carrier gas in a silicon dioxide PECVD process, the following advantages can be obtained: (1) reduced damage from ion bombardment because helium is light, inert, and clean, (2) increased thermal conductivity, (3) suppression of unwanted gas phase reactions, thereby providing better surface uniformity, and (4) reducing unwanted Si-H, Si-N, Si-OH, N-H, etc. in the film (Abstract, page 2638, and page 2639, section II.). Therefore, it would have been obvious to one of ordinary skill in the art to utilize

helium as a carrier gas in the process of the combination of Ojha et al., Bouffard et al., Law et al., and Hwang with the reasonable expectation of successfully and advantageously obtaining the following advantages: (1) reduced damage from ion bombardment because helium is light, inert, and clean, (2) increased thermal conductivity, (3) suppression of unwanted gas phase reactions, thereby providing better surface uniformity, and (4) reducing unwanted Si-H, Si-N, Si-OH, N-H, etc. in the film.

32. Claims 18 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Bouffard et al. (USPN 5,409,743), in further view of Law et al. (USPN 5,861,197), and in further view of Hsieh et al. ("Characteristics of low-temperature and low-energy plasma-enhanced chemical vapor deposited SiO_2", 1993) and Batey et al. (USPN 5,068,124).

33. The combination of Ojha et al., Bouffard et al., and Law et al. teaches all the limitations of Claims 18 and 25 as set forth above in paragraphs 21, 22, and 25, except for a method wherein the flow rate of N_2 is about 3.15 SLM (3150 SCCM). Specifically, Bouffard et al. teaches an N_2 flow rate of about 1.59 SLM (value obtained from the flow rate information provided on Col.4, lines 54 – 59 of Bouffard et al.; calculations are omitted). Additionally, both Hsieh et al. and Batey et al. teach that a high flow rate of carrier gas is desirable in a PECVD process utilized to deposit silica from silane and nitrous oxide (Abstract and page 2638 of Hsieh et al., and Col.3, lines 1 – 38 of Batey et al.). Further, Hsieh et al. teaches that variables

such as total gas flow rate and gas ratio affect the electrical and physical properties of the deposited films (page 2639, section III.). Therefore, it would have been obvious to one of ordinary skill in the art to utilize a high carrier gas (i.e., N_2) flow rate, such as a rate of 3.15 SLM, in the process of the combination of Ojha et al., Bouffard et al., and Law et al., because both Hsieh et al. and Batey et al. teach that a high flow rate of carrier gas is desirable in a PECVD process utilized to deposit silica from silane and nitrous oxide. The exact value of the nitrogen flow rate would have been optimized by one of ordinary skill in the art in order to achieve the desired electrical and physical properties of the deposited film, as taught by Hsieh et al.

Double Patenting

34. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969). A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with

this application. See 37 CFR 1.130(b). Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

35. Claims 1 – 5, 7 – 21, and 23 – 25 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over (1) Claims 1 – 29 of copending published Application No. US 2002/0192393 A1 (corresponding to 09/867,662), and (2) Claims 1 – 20 of copending published Application No. US 2003/0059556 (corresponding to 09/956,916). Although the conflicting claims are not identical, they are not patentably distinct from each other because of the following reasons. Specifically, both Claims 1 – 29 of US 2002/0192393 A1 and Claims 1 – 20 of US 2003/0059556 teach all the limitations of Claims 1 – 5, 7 – 21, and 23 – 25 of the instant application, including the specifics of the PECVD process and the annealing process (i.e., temperature, process gases, pressure, flow rates, etc.), except for a method wherein the post deposition heat treatment is performed to minimize the presence of contaminant compounds such as Si-O-H-N in the film. However, since the deposition and heat treating processes taught by Claims 1 – 29 of US 2002/0192393 A1 and Claims 1 – 20 of US 2003/0059556 are equivalent to the applicant's claimed process, the post deposition heat treatment of US 2002/0192393 A1 and US 2003/0059556 would have inherently minimized the presence of contaminant compounds such as Si-O-H-N in the optical quality silica film.

36. Claims 6 and 22 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over (1) Claims 1 – 29 of copending published Application No. US 2002/0192393 A1 (corresponding to 09/867,662), and (2) Claims 1 – 20 of copending published Application No. US 2003/0059556 (corresponding to 09/956,916), in view of Chandross et al. (USPN 4,708,884). Specifically, both Claims 1 – 29 of US 2002/0192393 A1 and Claims 1 – 20 of US 2003/0059556 teach all the limitations of Claims 6 and 22 of the instant application as set forth above in paragraph 35, except for a method wherein the pressure is maintained by a vacuum pump having a controllable pumping speed, and the total gas pressure is maintained by controlling the pumping speed. The claims of US 2002/0192393 A1 and US 2003/0059556 are silent as to how the appropriate chamber pressure is maintained. Chandross et al. teaches that it was known in the art of silicon oxide deposition at the time of the applicant's invention to maintain the desired pressure in a vacuum chamber by controlling the pumping speed of a vacuum pump (Col.5, lines 48 – 60). Therefore, it would have been obvious to one of ordinary skill in the art to maintain the desired pressure during the PECVD process by controlling the pumping speed of a vacuum pump, as taught by Chandross et al., with the reasonable expectation of successfully and advantageously maintaining the desired pressure by utilizing a well-known, conventional means of doing so. Please note that art-recognized suitability for an intended purpose (in this case, the suitability of a controllable vacuum pump for

maintaining the pressure in a vacuum chamber) supports a *prima facie* obviousness determination (MPEP 2144.07)

37. The aforementioned double patenting rejections are provisional obviousness-type double patenting rejections because the conflicting claims have not in fact been patented.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Wesley D Markham
Examiner
Art Unit 1762

WDM

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